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This is the same as the method recommended by the late Professor Encke in the *Berliner Astronomisches Jahrbuch*, 1838, and is substantially the same as that given by Gauss in his *Theoria Motus Corporum Cœlestium*, art. ii.

Note on Dr. Morrison's Paper. By Professor J. C. Adams, M.A., F.R.S.

The reference to Hansen's paper should be made to *Abhandlungen der Sächsischen Gesellschaft der Wissenschaften*, Band iv. p. 249, instead of to Band ii. as stated by Dr. Morrison.

In this paper Hansen's object is not merely to express the coefficients of the series which gives the eccentric anomaly in powers of e, otherwise this might have been done much more simply in the following manner.

Calling g the mean, and x the eccentric anomaly, we have

$$g = x - e \sin x,$$

or

$$x = g + e \sin x,$$

which is in the proper form for the application of Lagrange's theorem for developing x or any function of x in terms of g and ascending powers of e.

Hence we have

$$x = g + e \sin g + \frac{e^2}{1 \cdot 2} \frac{d}{dg}(\sin^2 g) + \frac{e^3}{1 \cdot 2 \cdot 3} \frac{d^2}{dg^2}(\sin^3 g) + \frac{e^4}{1 \cdot 2 \cdot 3 \cdot 4} \frac{d^3}{dg^3}(\sin^4 g) + \&c.$$

whence by substituting for the powers of $\sin g$ their expressions in sines or cosines of multiples of g, and differentiating, we may readily obtain the function of g which multiplies any given power of e.

The numerical coefficient of the term in $(x-g)$ which involves

$$e^m \sin (m-2n)\, g$$

is

$$(-1)^n \left(\frac{m-2n}{2}\right)^{m-1} \frac{1}{(1 \cdot 2 \ldots n)(1 \cdot 2 \ldots \overline{m-n})}$$

where m is a positive integer, and n is either zero or a positive integer less than $\frac{m}{2}$, and $(1 \cdot 2 \ldots n)$ is to be put $=1$, when $n=0$.

The expressions for x and for the sines of multiples of x are developed to the 12th power of e by Schubert in the appendix to Bode's *Jahrbuch* for 1820. In the same appendix Schubert likewise gives the development of the true anomaly in terms of the mean to the 13th power of e.

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Oriani had already given this last-mentioned development to the 11th power of e in the appendix to the Milan "Ephemeris" for 1805.

The numerical coefficients which he finds differ in four cases from those given by Schubert, but I have recomputed the coefficients in these cases, and find that Schubert's results are correct.

There is a misprint, however, in Schubert's expression for the true anomaly at the foot of p. 230, where the coefficient of

$$e^{12} \sin 12g$$

should be

$$\frac{7218065}{2^{13}.3.7.11} \text{ instead of } \frac{7218065}{2^{13}.3^{7}.11}.$$

Delambre's formula is copied from Oriani's, and is therefore affected by the same errors, together with some additional typographical ones.

I have verified Schubert's result for (v), the true anomaly in terms of the mean, by the consideration that when $g=0$, the value of

$$\frac{dv}{dg} \text{ becomes } \frac{(1+e)^2}{(1-e^2)^{\frac{3}{2}}}$$

$$= 1 + 2e + \frac{5}{2}e^2 + 3e^3 + \frac{27}{8}e^4 + \frac{15}{4}e^5 + \frac{65}{16}e^6 + \frac{35}{8}e^7 + \frac{595}{128}e^8 + \frac{315}{64}e^9 + \frac{1323}{256}e^{10}$$
$$+ \frac{693}{128}e^{11} + \frac{5775}{1024}e^{12} + \frac{3003}{512}e^{13} + \ \&\text{c.}$$

By comparing Schubert's result with that of Dr. Morrison, we see that there are the following errata in the latter: viz. the coefficient of $e^{10} \sin 8\,\text{M}$ in the equation of the centre should be

$$-\frac{4745483}{2^9.3^4.5.7} \text{ instead of } -\frac{1182827}{2^7.3^4.5.7},$$

and the coefficient of $e^{12} \sin 10\,\text{M}$ should be

$$-\frac{76972457}{2^{11}.3^4.7.11} \text{ instead of } -\frac{769805651}{2^{12}.3^4.5.7.11}.$$

In Schubert's expression for $\frac{r}{a}$ in p. 231, which is also carried as far as e^{13}, there are the following errata, which are evidently merely typographical: viz. in the coefficient of $-\cos 3g$, instead of

$$-\frac{3^6.11}{2^{17}.5.7}e^{11} \text{ should be } +\frac{3^6.11}{2^{17}.5.7}e^{11},$$

and in the coefficient of $-\cos 12g$, instead of

$$\frac{2.3}{5^2.7.11}e^{12} \text{ should be } \frac{2.3^6}{5^2.7.11}e^{12}.$$

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Oriani's formula for the radius vector has been examined and found correct.

A very good investigation of the general term of the expansion of the true anomaly in terms of the mean is likewise given in a paper by Mr. Greatheed, in the first volume of the "Cambridge Mathematical Journal," p. 208 (p. 228 in the second edition).

The approximate expression for the eccentric anomaly in terms of the mean given by Dr. Morrison in the latter part of his paper conincides with the first two terms of the series found in Keill's "Astronomical Lectures," p. 291 (5th edition, 1760), and the method of correcting an approximately known value which Dr. Morrison quotes from Encke is identical with Newton's method for the same purpose, which is also explained in Keill's "Lectures," p. 296 *et seq.*

On this subject reference may also be made to my paper in the *Monthly Notices* for December 1882, p. 43.

In addition to the errata already specified, the following may be noticed :—

In Oriani's formula for the equation of the centre, in the Milan "Ephemeris," 1805, pp. 14 and 15,

In the coefficient of sin $4g$,

instead of $-\frac{1367}{2^7 . 3^3 . 7}e^{10}$ read $-\frac{1619}{2^7 . 3^3 . 7}e^{10}$.

In the coefficient of sin $5g$,

instead of $-\frac{3649663}{2^{17} . 3^3 . 7}e^{11}$ read $-\frac{4305913}{2^{17} . 3^3 . 7}e^{11}$.

In the coefficient of sin $6g$,

instead of $+\frac{7751}{2^{10} . 6}e^{10}$ read $+\frac{7751}{2^{10} . 7}e^{10}$.

In the coefficient of sin $11g$,

instead of $\frac{63039512101}{2^{17} . 3^4 . 5^2 . 7 . 11}e^{11}$ read $\frac{62929017101}{2^{17} . 3^4 . 5^2 . 7 . 11}e^{11}$.

As Delambre's formula is copied from Oriani, it is affected with the same errors, and in addition to these the following errata occur :—

In the Introduction to Delambre's Solar Tables, 1806,

In the coefficient of sin g,

instead of $\frac{565879}{2^{16} . 3^2 . 5^2}e^{11}$ read $\frac{565879}{2^{16} . 3^3 . 5^2}e^{11}$.

In the coefficient of sin $6g$,

instead of $-\frac{7913}{2z . 5 . 7}e^8$ read $-\frac{7913}{2^7 . 5 . 7}e^8$.

In the coefficient of sin $7g$,

instead of $-\frac{1173271}{2^{14} . 3^2 . 5}e^9$ read $-\frac{177327I}{2^{14} . 3^2 . 5}e^9$.

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And in his "Astronomy," 1814, vol. ii. p. 52,

In the coefficient of sin $2g$,

instead of $+\frac{677}{2^2 \cdot 3^3 \cdot 5}e^{10}$ read $+\frac{677}{2^9 \cdot 3^3 \cdot 5}e^{10}$.

Also in Delambre's expression for $\frac{r}{a}$ the following errata occur:—

In the Introduction to his Solar Tables, 1806,

In the coefficient of $-\cos g$,

instead of $-\frac{3}{2^2}e^3$ read $-\frac{3}{2^3}e^3$.

In the coefficient of $-\cos 5g$,

instead of $+\frac{5^6}{2^{13} \cdot 9}e^9$ read $+\frac{5^6}{2^{13} \cdot 7}e^9$.

And in his "Astronomy," 1814, vol. ii. p. 51,

In the coefficient of $-\cos 5g$,

instead of $\frac{53}{2^7 \cdot 3}e^5$ read $\frac{5^3}{2^7 \cdot 3}e^5$.

Also in Delambre's formula for the hyperbolic logarithm of the radius vector, the following errata occur:—

In the Introduction to his Solar Tables, 1806,

In the coefficient of $-\cos 2g$,

instead of $-\frac{9}{240}e^8$ read $-\frac{9}{640}e^8$.

In the coefficient of $-\cos 8g$,

instead of $\frac{47529}{2^{10} \cdot 5 \cdot 7}e^8$ read $\frac{47259}{2^{10} \cdot 5 \cdot 7}e^8$.

And in his "Astronomy," 1814, vol. ii. p. 50,

In the coefficient of $-\cos 7g$,

instead of $\frac{355081}{2^{10} \cdot 3^2 \cdot 5^7}e^7$ read $\frac{355081}{2^{10} \cdot 3^2 \cdot 5 \cdot 7}e^7$.

On the Orbit of γ Coronæ Australis. By A. M. W. Downing, M.A.

Elements of the orbit of this binary star have been published by Professor Schiaparelli in *Astronomische Nachrichten*, No. 2073, and a comparison of observed and computed places given up to the date 1875·65, from which it appears that these elements represent the series of observations made up to that date extremely well. As several more recent observations of γ *Coronæ Australis* have now been published, I have determined the corrections applicable to Schiaparelli's elements in order that the places computed from them may be brought into rather better accord with the whole series of observations extending from 1834·47 to 1880·67.